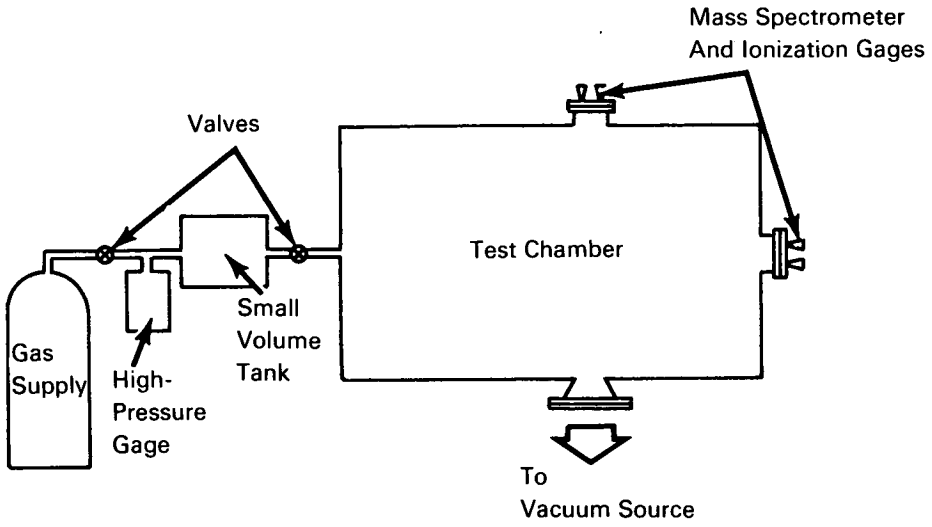
NASA TECH BRIEF

Volume-Ratio Calibration System for Vacuum Gages



The problem:

To determine whether the expansion of a gas from a small volume into a large volume can be relied upon to create accurately known pressures in the range 10^{-7} to 10^{-3} torr, and thus provide a calibration medium for commercial vacuum gages in this range.

The solution:

A system consisting of a gas source, high pressure gage, small volume tank, large volume (test) chamber, plus appropriate piping, valves, and vacuum source. This system is used, in conjunction with commercial vacuum gages, to evaluate its ability to accurately produce desired pressures in the 10^{-7} to 10^{-3} torr range.

How it's done:

The test chamber is initially evacuated by the vacuum source to its ultimate pressure. Ionization gage readings become constant after an interval of gage outgassing. The small volume tank is evacuated and a quantity of the test gas is then valved into it from the supply, creating an initial pressure measured by the high pressure gage. The test chamber is sealed off from the vacuum source and the time is recorded in order to establish the elapsed time for the test. Rate of rise in the test chamber is observed for a period sufficient to establish the outgassing rate accurately. A given amount of gas in the small volume tank is valved into the test chamber and allowed to reach a state of equilibrium. Pressure in the small volume tank is recorded plus the readings of the ionization gages in the test chamber and the time of readings is noted. Tank wall and room temperatures are taken in order to include isothermal conditions in the calculations. This procedure is then repeated for a number of gas transfers in order to acquire a meaningful average.

(continued overleaf)

Notes:

1. Error analysis disclosed a limit of error from about 6% at 10^{-7} torr to 1% at 10^{-3} torr.
2. Five commercial hot filament ionization gages were calibrated in the 10^{-6} to 10^{-3} torr range in nitrogen gas. The results of 350 data points showed about 3% reproducibility in the gages—approximately equal to the readability factor of the gage indicators.
3. Further information concerning this innovation is presented in NASA TN D-3100, "Evaluation of a Volume-Ratio Calibration System for Vacuum Gages from 10^{-6} Torr to 10^{-3} Torr", by Raymond Holanda, November 1965, available from the Clearinghouse for Scientific and Technical Information, Springfield, Virginia 22151; price $1.00. Inquiries may also be directed to:

   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B66-10640

Patent status:

No patent action is contemplated by NASA.

Source: (Lewis-303)